L.I.S.T. Group

LONG ISLAND
SINCLAIR TIMEX
GROUP

Hello DON!
HERE'S A SAMPLER
OF OUR NEWSLETTER.

1985

LIST
P.O. BOX 438
Centerport, N.Y. 11721-438

Dear Inquirer:

The LIST GROUP has been formed to help keep the spirit of the Sinclair-Timex "peoples" computer alive. At this point, we're getting organized; officers have been elected and a monthly newsletter started. A Charter is yet to be written, but "meetings" are held once per month, usually in member's homes.

Despite the lack of a written charter the general goals of our group include:

1) Exchange of information, ideas and knowledge on and about TS computers.

2) Hardware and Software demonstration and perhaps even exchange.

3) Community service to increase computer literacy.

4) Perhaps some advantage to members through the exercise of group buying power.

Right now we have about 60 members and a modest budget. A circulating tape library has begun, and we have generated a pretty substantial newsletter, a few sample pages of which are attached. See the newsletter pages for membership/subscription information.

Write to us and tell us what you'd like to see in the newsletter and/or send us some of your work to share with other members. Special Interest Groups - TS 1000 and TS 2008/Spectrum, will soon be forming.

Hope to hear from you soon.

Paul Donnelly
Sec'y Treas.

LONG ISLAND SINCLAIR TIMEX GROUP

LISTing Policy:

Annual Dues.....$15.00 Issue Price $1.50 (includes P&P)

One "Sample" copy sent upon receipt of large SASE.

Copies provided on exchange basis with other bona fide user groups.

L.I.S.T.ing is published monthly by LIST (Long Island Sinclair Timex) Group
a not-for-profit users group

Your reviews, programs, comments, hardware projects, etc., are eagerly solicited for publication in LISTing.

Please note our new address - P.O. BOX 438, Centerport, N.Y.11721-0438
Mail sent to the old address must be forwarded there and will take longer to reach us.

NOTE: PARTIAL YEAR MEMBERSHIPS AVAILABLE

Normal membership year is Feb. through Jan. at cost of $15.00.(US)
By keeping as many members as possible on that basis, we keep our costs and chances of error down.

If you wish to begin subscribing later in the year, please sign up for the end of this year and all of next.

We will accept partial years or different subscription runs, on a limited basis (particularly from members outside the U.S.) But, please be aware that, addition to possible rate increases, your "account" must be handled "by hand" and errors may occur. International (EX Canada) subscribers will receive as many issues as we can afford to mail.

CLASSIFIED ADS

Got something to sell or trade? Members get a free one time insertion of up to 50 words. 10¢/word-otherwise (your photo ready copy); 15¢/word-we compose.

SPECTRUM ROMs - $19.95 (18.00 for List members) includes P & P. LIST Associates, 10 Idle Day Drive. Centerport, N.Y. 11721.

DK'Tronics Light Pen (for Spectrum - works on 2068 buss) $35.00 (includes P & P) LIST Associates, 10 Idle Day Drive, Centerport, N.Y. 11721.

A NOTE ON: LIST ASSOCIATES
LISTA is a cooperative buying service. It is not an official organ of LIST Group.

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LONG ISLAND SINCLAIR TIMEX GROUP (L.I.S.T.) supports ZX81, TS 1000 and TS 2068 computers. Annual dues $15. - includes a monthly newsletter and library program cassettes. Sample newsletter on request. Include a large S.A.S.E. with 37 cents postage. Spectrum ROMS for sale $19.95 includes P&P. L.I.S.T. PO Box 438 Centerport, NY 11721-0438

POLICY ON CONTRIBUTED MATERIAL:

We are always looking for interesting articles, programs, reviews etc. to help keep our members informed and entertained. Articles submitted for publication are printed on the following basis:

1. You the writer, maintain the full copyright and can resell, lend or give away your work, as you wish.

2. We are granted the right to publish your material, in the original issue in which it appears. Reprints (e.g., to supply orders for back issues) will include your material as a part of its original issue. We are not allowed to sell your material in any other way, without your express written consent;

We can't (for now) pay you for your material, but you will recieve a copy of the issue in which it is published, even if you're not a member. You may get more than one issue and you will definitely earn the respect and appreciation by your greatful peers.

If you have a program or article about something you've tried, please send it in. Our group interests are so varied that I can almost certainly guarantee that someone else can use your expertise to solve his problem.

February 1985

2-85

ADAPTING THE TI KEYBOARD TO THE TS1000

This article is for those lucky people who have delayed, hesitated or just have not gotten around to wiring up their "big" keyboards.

In the last few months Texas Instruments has dumped on the surplus market a huge quantity of new components designed for use with the now defunct TI 99/4, including power supplies, RF modulators and TMS 9918 chips. One of the prize finds from this lot is the 48 key keyboard which can be purchased from numerous vendors; prices range from $3 to $10 (a list of vendors is provided for you at the end of the article).

The hardware of the TS keyboard system is quite straightforward. It consists of 40 normally open switches and eight diodes arranged in a matrix pattern. The status of the switches is periodically read by the ROM by an IN instruction to port FEH. These details, however, are not of concern in wiring up your keyboard; the object of the task is to duplicate the wiring of the membrane pads.

Preparing the Keyboard

The steps involved in transforming your keyboard from TI to TS follow. The instructions are the same for the grey or the black keyboard; they are functionally the same. Do note, however, that the keytops are not interchangeable as their slopes are different. You can also do this project by rerouting traces on the PC board (by cutting and jumpering), but this method can put you in a foul temper in very short order. I chose to start with a clean slate by eliminating all the traces.

Desolder all key contacts (2 Each) on the PC. This job is made easier with a vacuum type desoldering gun from Radio Shack-($6.95). Desolder and store the very important cable connector TI provides; you will need it later.Carefully pry the PC board off the keys. It will separate cleanly with a little urging. Never mind that lots of little washers have also fallen under the workbench, lost for posterity, you will not need them.The next step is to grind off all the foil and the green protective layer leaving a naked epoxy board ready to hardwire to your specifications. Note that the method of attack for this job is dictated by the technology available to you and/or how hard you like to work at things. I used a grinder with a 6 inch wheel passing the board in front of the small cutting surface many, many times. My thought during this process was how much easier this would be with a belt sander. Once the board is stripped you can be proud of yourself for having reversed the work of mighty TI for use on your humble ZX. Don't stare at it too long; the main part of the conversion is yet to come.

Wiring Your Keyboard

First decide where you will locate the mechanical shift lock key. This will not be possible once wiring is underway. I used 30AWG wire wrap wire successfully for the whole project. I suggest you get as many colors as you can afford. FIG 1. is a diagram from the MULE Electronics Keyboard Symbol Kit. The diagram shows all necessary connections. You can daisy chain rows or columns if you use bare wire. This saves a considerable amount of time over cutting small lengths of wire as you will have to for the rest of the project. Once the matrix is wired, you are ready for your bonus; shifted function special purpose keys.The rule to remember in wiring these is to evaluate the shortest route to a particular Address or KB line, before you take soldering gun in hand. It's beyond the scope of this article to detail the methods used to obtain shifted functions or repeat keys. Articles in Sync, Syntax and TS Horizons have covered these topics. The MULE Kit also covers the subject thoroughly, providing diagrams on how to obtain all of the shifted functions. This is one area where you can customize your computer to put it into a category by itself. I have wired 4 special purpose keys and find that I use them constantly to increase the utility of data base and word processing programs.

Connecting Your KB to the Computer

There is no easy single way to bring keyboard and Address lines from your new keyboard to the computer chassis. The connector provided (remember I asked you to save it) by TI has 15 slots; it is a press- on type of connector. Standard ribbon cable can be push fitted into these slots with the help of a screwdriver. Once this is done you have a connector with a long stretch of ribbon cable. HOW do you get this secured to your newly rewired keyboard? One way is to epoxy a strip of a single in-line IC spacing header to the KB and to solder your cable/connector assembly to this (See Fig.3) The header material can be bought in a strip and cut to the 15 position size to fit into predrilled holes already there. Radio Shack no longer carries this material but it can be bought from a variety of other sources.

Now, on to the last bit of wiring; To finish the project you must bring your KB and Address lines to your new header. The thing to remember here is that your 5 KB lines will be on the left and your 8 ADD lines will be on your right on the finished project. If you are going to retain the keyboard connectors on your computer chassis you will have to make a one sided .1 spacing edge connector to fit into the TS keyboard connectors (See FIG 2.). You can use the Zebra C112 45 pos male card edge connector ($2.50)cut down to size (8 and 5 slot) and with the back traces buffed off to fit into the KB connector slots. Of course the other alternative is to directly wire the keyboard to the chassis.

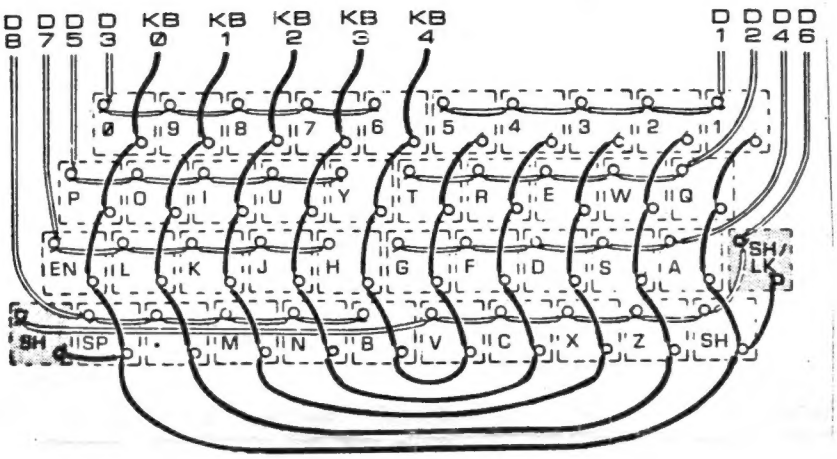
The last part of the project is to install your new keytops from the MULE kit. These high quality plastic symbol tops go on easily, look professional and seem to last forever. Comprehensive instructions are enclosed with the product. The symbols on the sides of the TI keys can be sanded off easily with 500 grit while you are doing your keytops.

By now you are either totaly confused or the proud owner of a newly converted TS/TI keyboard. For the adventurous few who absolutely demand a numeric keypad, this too is possible. You must buy a second keyboard to scavenge the keys. If you would like to do this project, send S.S.A.E. and I will send you a drilling template and wiring diagram.

3-85

Cem Barut

FIG1.



WIRING OF KEY-SWITCH TERMINALS (BOTTOM VIEW)

Mule Electronics
Dept.310
444 Lincoln Blvd.
Venice CA 90291
213-452-1205
TS1000 KB Conv.Kit-$11.95
Shifted Fn. Set-$5.00

Source of TI KBs
Radio Shack
Anywhere USA
Check availability

Arnold Co.(TX)
214-576-229
5.95

American Design Components(NJ)
201-939-2710
$5.95

Sabet Elect.(TX)
214-234-8032
$3.50

Lolin Elect.(TX)
214-234-8032
$3.50

FIG3.

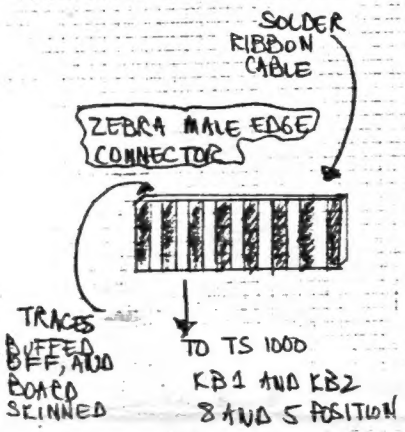
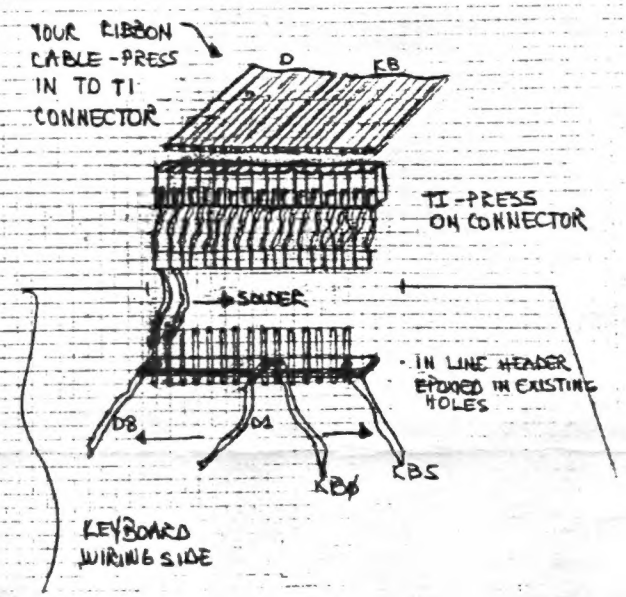


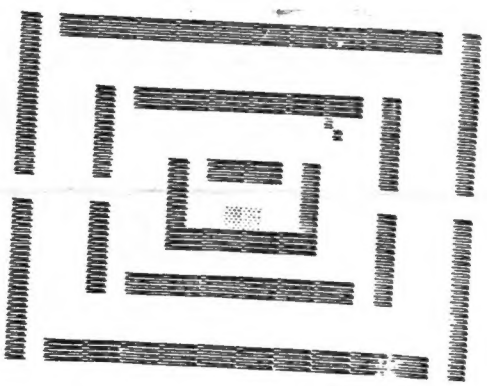
FIG2.



3-85

List Group

```
   5 REM ROBOT
  10 SLOW
  20 PRINT AT 4,2;"HERE ARE YOUR
 CONTROL KEYS:"
  30 PRINT AT 6,13;"U I O"
  40 PRINT AT 7,13;"J   L"
  50 PRINT AT 8,13;"N M."
  60 PRINT AT 1,2;"PRESS<ENTER>T
O CONTINUE."
  70 LET K$=INKEY$
  80 IF K$<>CHR$ 118 THEN GOTO 7
0
  90 CLS
 100 FAST
 110 LET SC=PEEK 16396+256*PEEK
16397+1
 120 LET S=1000
 130 LET HR=13
 140 LET HC=18
 150 LET F=0
 160 LET HS=0
 170 LET P1=1
 180 LET P2=1
 190 LET J=0
 200 LET D$="8,25,3,10,21,6,12,1
9,8,1,17,11,10,21,14,6,25,17,3,
2,4,1,17,4,6,9,8,11,14,8,8,11,1
2,6,11,19,6,8,23,11,14,23,3,9,27
,11,17,27,"
 210 PRINT AT 9,15;CHR$ 136
 220 PRINT AT 9,16;CHR$ 136
 230 FOR X=1 TO 16
 240 GOSUB 1000
 250 LET A=VAL N$
 260 GOSUB 1000
 270 LET B=VAL N$
 280 GOSUB 1000
 290 LET C=VAL N$
 300 FOR Y=A TO B
 310 IF X<=6 THEN PRINT AT C,Y;C
HR$ 138
 320 IF X>6 THEN PRINT AT Y,C;CH
R$ 138
 330 NEXT Y
 340 NEXT X
 350 LET H1=INT (RND*20)
 360 LET H2=INT (RND*3)+28*(RND>
0.5)
 370 SLOW
 380 PRINT AT 21,14;S;""
 390 LET S=S-1
 400 LET J$=INKEY$
 410 IF J$<>"" THEN LET J=CODE J
$
 420 LET RO=H1+(J=27 OR J=50 OR
J=55)-(J=46 OR J=52 OR J=58)
 430 LET CO=H2+(J=27 OR J=49 OR
J=55)-(J=44 OR J=51 OR J=58)
 440 LET RO=RO-(RO>20)+(RO<0)
 450 LET CO=CO-(CO>31)+(CO<0)
 460 IF PEEK (SC+RO*33+CO)<>128
THEN GOTO 500
 470 LET RO=H1
 480 LET CO=H2
 490 GOTO 550
 500 PRINT AT H1,H2;CHR$ 0
 510 PRINT AT RO,CO;CHR$ 23
 520 LET H1=RO
 530 LET H2=CO
 540 IF RO=0 AND (CO=13 OR CO=16
) THEN GOTO 740
 550 LET RA=HR+(RO>HR)-(RO<HR)
 560 LET CA=HC+(CO>HC)-(CO<HC)
 570 LET RA=RA-(RA>20)+(RA<0)
 580 LET CA=CA-(CA>31)+(CA<0)
 590 LET CH=PEEK (SC+CA+33*RA)
 600 IF CH<>128 AND CH<>136 THEN
 GOTO 680
 610 LET RA=HR
 620 LET CA=HC
 630 LET D=2*INT (RND*2)-1
 640 IF F THEN LET RA=HR+D
 650 IF NOT F THEN LET CA=HC+D
 660 LET F=NOT F
 670 GOTO 580
 680 PRINT AT HR,HC;CHR$ 0
 690 PRINT AT RA,CA;CHR$ 134
 700 LET HR=RA
 710 LET HC=CA
 720 IF CO=CA AND RO=RA THEN GOT
O 800
 730 GOTO 380
 740 CLS
 750 IF S>HS THEN LET HS=S
 760 FOR T=1 TO 50
 770 PRINT "YOU DID IT."
 780 NEXT T
 790 CLS
 800 PRINT "YOUR SCORE IS";S;"."
 810 GOTO 840
 820 CLS
 830 PRINT "SORRY YOU WERE CAUGH
T."
 840 PRINT "THE HIGH SCORE IS";H
S;"."
 850 PRINT "PRESS<ENTER>TO PLAY
AGAIN."
 860 LET K$=INKEY$
 870 IF K$<>CHR$ 118 THEN GOTO 8
60
 880 GOTO 90
1000 IF D$(P1)="," THEN GOTO 103
0
1010 LET P1=P1+1
1020 GOTO 1000
1030 LET N$=D$(P2 TO P1-1)
1040 LET P1=P1+1
1050 LET P2=P1
1060 RETURN
```



HARDWARE REVIEW

ITEM: GAME CHANGER INTERFACE
PURPOSE: CHANGE ATARI GAMES
SYSTEM: 8K ROM/2K RAM & ATARI 2600
FROM: HURON VALLEY RESEARCH INC.
PO BOX 732
HIGHLAND, MICHIGAN 48031
PRICE: $125.00 + $5.00 S&H

Clever hardware construction, both mechanical and electronic, and a solid comprehension of both 6502 (the ATARI 2600's CPU) and Z80 (TIMEX) programming are combined to produce the very powerful "Game Changer Interface". The unit cross-connects your 2600 VCS (Video Computer System) and TS 1000, allowing either one to take control of whole blocks of shared memory. That "shared" memory includes the ROM inside any ATARI game cartridge and "shadow" copies of that ROM in your TS 1000's RAM. With this system you can download the ROM game to your ZX/TS, dissassemble the machine code (6502), make games variations or even create your own game from scratch, and then upload your version back to the 2600 for play.

The system consists of two double-sided, plated-through open boards, professionally constructed. The larger, or mother, board plugs into the back of your unexpanded ZX/TS and connects via ribbon cable to the smaller VCS adaptor board. This latter has male and female edge connectors. One inserts into the cartridge slot in your VCS, while game cartridges can be installed in the other.

The mother-board contains 4 HM 6116's (2K Static RAM), and uses some ingenious coding to remap internal RAM above that 8K, for a total of 10K RAM (12K with an extra chip and some soldering). The 4K above RAMTOP contain the actual ROM of the game cartridge. For any size cartridge, the game information is transferred to a long REM statement for storage. Cartridges over 4K are handled using a bank switching technique like ATARI's. Game execution is accomplished by transferring the game data to the actual bottom of RAM using menu driven software and then placing the TS 1000 in a bus requested mode when power is applied to the 2600.

The smaller cartridge adapter board uses the strength of the fibreglass board to open the VCS and cartridge door slots, and has an on-off switch to allow insertion and removal of cartridges while the system is on.

Menu driven software is supplied on cassette. It includes 2 programs of BASIC and ML which are required to download the cartridges, one for 2-4K games and one for 8K. The 8K game actually works for any size game, but takes longer to SAVE and LOAD, a bother if your actual cartridge is a short one. The third program is called "Change" and that's exactly what it does. A simple 6502 dissassembler and monitor are included in this program. They allow you to review the code and change it at will. This is a very nice feature for those shoot-em-up games where you wish you had "just one more ship".

The system works very well and even comes with high quality RF cables and 3 way switch box for your TV set. You need that switch box, unless you use two sets, to switch back and forth between what your VCS and TS are putting out on channel 3 (or 2). I installed an extra 2K RAM chip as insurance for my disk drives data transfer buffer and found the system 100% compatible with AERCO's disk drive. With that system combination I can download, save or retrieve any program in seconds. The question of speed though, does lead us to the few negative aspects of the system.

8K cartridges download into what, in effect, are 10K BASIC programs, and we all know how long they take to load from tape. After you modify, or make your new game, you may want to have an EPROM burned. Also, as the system uses BUSREQ you'll have trouble using the dynamic RAM's (e.g., as in a 16K RAMPACK) in other system expansions. Hunter's board, populated with 6116's, should work, if your decoding is complete.

I had very little trouble loading the programs. The menus are simple and the documentation is spartan. That documentation consists of 7 photocopied typewritten sheets. It includes an installation sketch and hand drawn schematic, essential memory map locations and operating instructions. Perhaps the only flaw in an otherwise superb system, the documentation is brief, and has a number of typos, though none are serious.

Huron Valley promises to dress up the paperwork to match the quality of the rest of their system and to produce a "Tuterial" (sic) newsletter for owners. Adapters to allow use of the system on 1500's and 2068's are also in the works. Overall, while less than perfect documentation usually causes a severe downgrade, I must rate the "Game Ganger" highly. It is exceptionally powerful and well designed, and could provide the ultimate in inexpensive game play and design system for a total investment of less that $175 (including a TS 1000). Overall rating is a 9 out of 10 and would be higher at a slightly lower price.

One final note about Huron Valley, they are exceptionally helpful and courteous on the phone (the owner's home phone number is supplied), and must be rated one of the supportive vendors I've met.

HARDWARE REVIEW

ITEM: DK TRONICS KEYBOARD
FROM: DK TRONICS, SUFFERN -WALDEN, ENGLAND (799-26350)
PRICE: $72.00 + S&H (Depends on exchange rate)

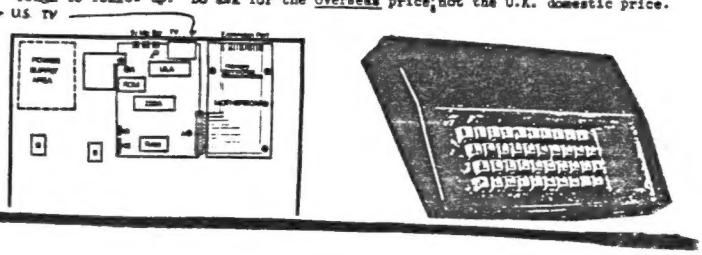
About a month after my second order (the first bounced because of some problems with VISA), I received my DK'Tronics "big" keyboard for my TS/1000.

The keyboard case is made of a soft black plastic and has 40 grey keys and an additional 12 red keypad keys. The feel of the keys is good and clear vinyl markers on each key contain the standard Sinclair codes, as used in the U.K. (e.g., NEWLINE for ENTER). Inside the case is DK's "motherboard" which is simply an extension of the ZX81 buss to the rear of the case, but which has an extra male connector sticking up. This extra connector allows you to securely mount any one peripheral inside the case. The usual choice, and mine, is to install a 16K memory pack in this area. This leaves the newly exposed rear connector available for other devices. DK also provides enough room for small internal power supply for graphics ROM assembly. The standard phone plug connectors are exposed through a slot in the back of the case.

Assembling the DK'Tronics keyboard was easy-for the most part. Standard installation requires only that the DK keyboard and ZX81 have the screws holding them together removed and the ZX81 P.C. board placed inside the keyboard case. The ZX board plugs in to the motherboard via the edge connector. Two specially prepared connectors then simply plug into the keyboard slots. There is one problem with th standard installation however. The DK product is intended for use with a UHF modulator. These come out of the case about 1 1/2" further forn the back than the USA's VHF output and an extra 1/2" hole has to be drilled in the case. This is no a problem, as the material is very soft and easier to work than wood.

The workmanship on the board I received was not very good. I had to realign the motherboard and found some of the wooden mounting blocks somewhat off enter, as well. Also, DK made no provision for the Ch2 - Ch3 switch in the bottom of the case. Finally, an obvious mold flaw mars the finish on top of my unit.

Other shortcomings include the lack of a space bar, the use of a wooden bottom plate and the total lack of shielding (not required in the UK, I'd guess). These shortcomings are offset somewhat by the fine "feel" of the keyboard, the ease with which the plastic material can be worked, the reasonable price and the extra numeric keyboard. On balance, I would rate the DK's keyboard a reasonable value for the money, but recommend you be prepared to use simple hand tools (screwdriver, hand brace, pliers) to "finish" your keyboard. I expect a warranty claim would be tough to follow up. Do ask for the Overseas price, not the U.K. domestic price.



Marty J., has been entering some Microsoft BASIC programs into his 2068. He offers the following sample correlation for STRING handling.

MISCROSOFT	RESULTS	SINCLAIR BASIC
MID$(A$,3,2,)	LL	A$(3 to 4)
LEFT$(A$,2)	HE	A$(to 2)
RIGHT$(A$,2)	LO	A$(LEN(A$)-1 To)

MICROSOFT BASIC

```
10 A$="HELLO"
20 LPRINT MID$ (A$,3,2)
30 LPRINT LEFT$(A$,2)
40 LPRINT RIGHT$(A$,2)
LL
HE
LO
```

(tempo)

SINCLAIR BASIC

```
10 LET A$="hello"
20 PRINT A$( TO 2)
30 PRINT A$(3 TO 4)
40 PRINT A$(LEN A$-1 TO )
he
LL
LO
```

NOTE: Lines 20 & 30 are reversed.

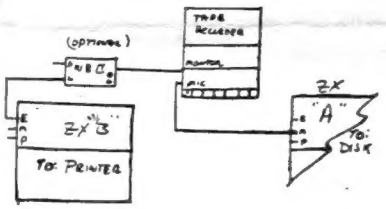
MACHINE TO MACHINE TRANSFERS

With the current low prices being what they are, and the plethora of incompatible peripherals out there, I suspect that may others may be in my predicament.

Picture this;

You have two ZX/TS machines, one hooked up to a disk drive, the other to a non-Timex printer. You can't connect both peripherals at the same time because there addressing schemes conflict. You develop your software on the disk drive for speed in making backups and for crash recovery, but would like to transfer the data to the ZX with the printer. Normal procedure here would be to "SAVE" the program to tape from the disk machine and then LOAD the program back to the printer machine for output, a process that can require as much as 15 minutes for a 16K program.

That time could be cut in half if you could directly download from machine A (the disk equiped system) to machine B (the printer). This isn't easy, as the output from machine A is only at about 5 millivolts while the input machine B is looking for needs to be about 5 volts P-P. It can be done though, and a backup copy made at the same time, if you have the right type of recorder (I used a Panasonic RQ 2107A, but most portable machines should work.) The secret is to use the "monitor" function built into most machines. Hookup is as shown below:



The monitor jack will provide a boosted signal which should drive the second machine. Procedure is:

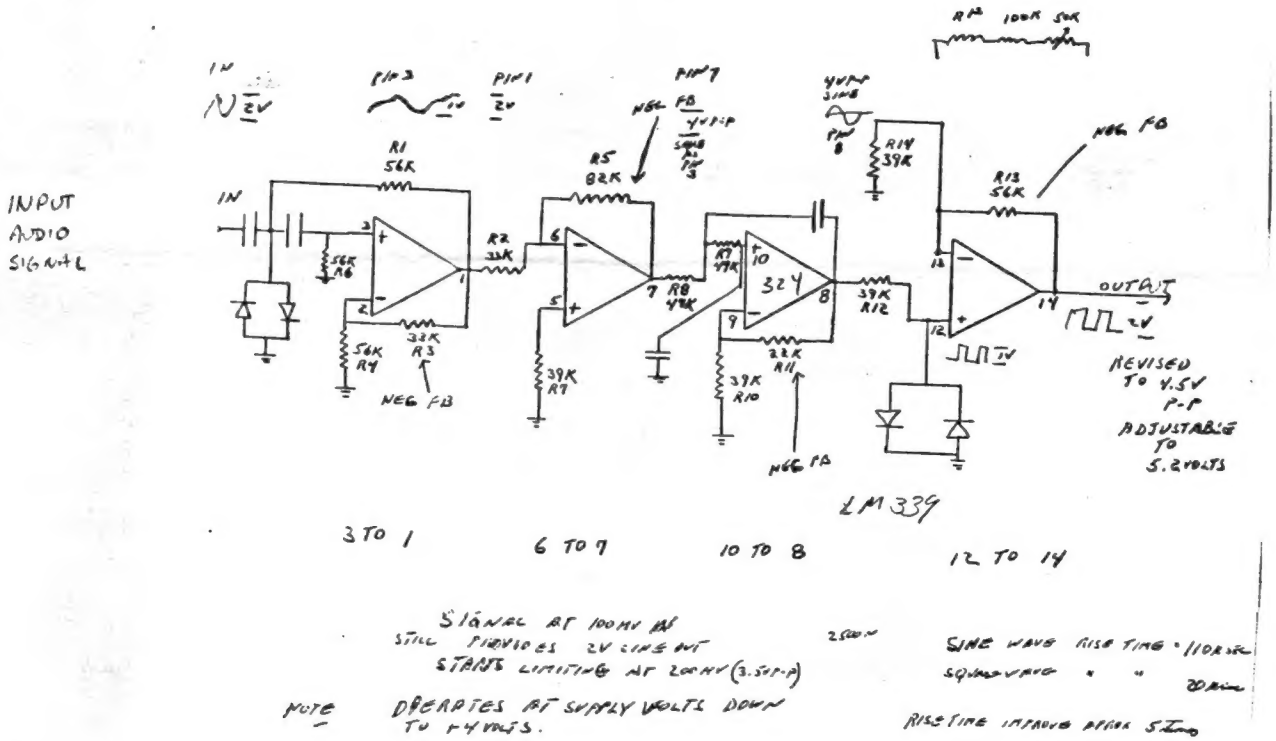
1. With all three machines powered up and connected as shown, enter LOAD "" in machine B.
2. START the Tape recorder with record and play pressed and a tape installed.
3. Enter SAVE "PRGNAME" in machine A.
4. You should see the normal load and save patterns if you alternately plug in the RF cable from each machine into the TV-Game switch's RCA jack input. Two TV's, if available, make the whole procedure easier.
5. When machine A is done, you're all set. Print out the data from machine B and you've even got a backup copy on tape.

Note that the Winky Board II may be optional depending on your machine's output and that it should be hooked up in the standard "LOAD" mode.

Also note that the "monitor" jack on most portable players produces a fixed output which may or may not be suitable for loading.

Finally, if you don't want to use a tape (even on old "dummy" one), you'll need to stick the eraser end of a pencil into your tape player and hold back the write protect latch. This is a little finger in the left rear of the cassette compartment, which is held back by the breakaway tabs located on the back ends of standard blank cassettes. Holding it back simulates the presence of a recordable cassette (i.e., with tabs intact).

"SMOOTHER" By H. Hanken
(Prototype)



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LISTING

TO:

LIST
P.O. BOX 438
CENTERPORT, N.Y. 11721-0438

LIST
P.O. BOX 438
CENTERPORT, N.Y. 11721-0438

TO:

The other two lines provided by the printer interface are $\overline{STB}$ and $\overline{ACK}$ (strobe and acknowledge). I used the interface with a Centronics 101 printer and Ener-Z says it works with EPSON and should work with most other Centronic style printers. I agree, but suggest you include your printer type in any correspondence you have with Ener-Z.

After getting my R.G. board, I put it through its paces, on and off, for over a month. The RTC lost only a few seconds, and I hooked up switches (joystick actually) to the input ports. I've used the output ports, all eight lines, with two off-board chips to drive a 3 digit 7 segment display. This last lets me see measurement status without turning on my TV. The A/D converter measured some resistance circuits I'd set up quite accurately and I've even tied it into a thermistor and gotten a fairly good thermometer, accurate without amplification to about 2-3°F. To get the printer interface working, you'll need to make up your own cable. You can get everything you'll need at Radio Shack or a number of the mail order houses. Try to keep your cable under 8-10 feet in length.

If the R.G. board sounds pretty good up to this point, make no mistake, it is. However, it seems that nothing is ever absolutely perfect and there are some negative aspects to the board. Minor turn offs which don't really affect the boards performance included a loose battery connector on my board, some "afterthought" pull up resisters tacked on to assure TTL-CMOS compatiablity and the lack of a case. Three more meaningful items, which might even affect your decision to get an R.G. board, do need mentioning. First, is the somewhat hastily prepared documentation. While there is an excellently documented source listing for the EPROM, the supporting narrative on BASIC applications has quite a number of typos and no page numbers. The 29 page documentation swings back and forth between the EPROM and RAM based USR calls, and while a mini hex monitor for loading the RAM version (you must enter this by hand) is provided, the code listing is not. I'd suggest that Ener-Z either prepare two separate versions of the documentation or one complete and comprehensive dual purpose version. I think the average user will be able to use the board, but straight BASIC programmers (i.e., who don't use ML and have little hardware knowledge), may find they'll have to make a call or two to Ener-Z for guidance. I found them most helpful on the phone, myself.

The next complaint is one I have voiced before. This is that we're not told explicitly in either advertising or documentation, which port locations are used. In the case of the R.G. board, with a little digging, the source listing documentation does indicate addresses 01,03,05 and 07. However, a quick look at the board's partial decoding will show you that any odd numbered port below 80H will respond to the I/O calls from EPROM. Keep this in mind if you have other I/O mapped peripherals.

The other significant "flaw" with the R.G. board has to do more with the "nature of the (TIMEX) beast" than with the board itself. As you probably know, the ZX/TS cannot directly address I/O ports. In order to do so then, we must jump to an ML (machine language) I/O routine and this means using FAST mode and consequently lots of blank screen time and "flicker". I probably wouldn't have thought this to be a significant problem if I hadn't seen JK Audio's 310 board. While this board costs about as much as the R.G. and has fewer features as a stand alone board (I/O ports and clock only), it uses memory mapping to accomplish its I/O functions. This means that the JK board can be run completely from BASIC and provide a continuous rock-steady display while performing its I/O function. I don't feel the R.G. board should be downrated on function because of the difference, only that users should be aware of a need for a little more effort required to produce good looking screens with the R.G. board.

To more than make up for these little flaws, the R.G. offers its high reliability, numerous features, low cost and some bonus features not mentioned in its documentation. The board nominally has one 8 bit input and one 8 bit output port. You could concieveably stretch these, with some off-board multiplexing,to 64 each. How? Schmitt conditioning of signals fed to the A/D converter could give you 8 more digital input lines. Also, the printer port has 8 bits, this time with handshaking. There are other such combinations which you could implement with a few IC's to suit your particular application. A final extra bonus is that about 180 bytes of the EPROM are not yet programmed. Using sufficient care, and an EPROM programmer, you could use this area to add your own special USR routine to the board.

On balance, I found the R.G. board an excellent value and perhaps (next to my $39.95 TIMEX) the most cost effective computer purchase I've made. If you need any two of the board's features, I recommend buying it. I've given this board a hard to get 9.9 on my price-for-value scale. A "10" could be obtained if the unit were also offered as a kit, the RAM driven version was provided on tape, and documentation was cleaned up a little. Ener-Z has done an outstanding job with its first entry into the ZX/TS peripheral market. As a suggetion for further items, some detailed I/O applications (perhaps collected from users) could be provided and even hardware (e.g., temp probes, light pens, synthesizers) described or made available.

P.J. Donnelly

HARDWARE REVIEW

ITEM: REPORT GENERATOR BOARD — Everything Interface
FROM: ENER-Z COMPANY
PO BOX 635
FORT WASHINGTON, PA 19034
FEATURES: RTC, A/D, I/O PORTS, PRINTER INTERFACE
PRICE: $89.95 + PH - K.I.T. Assembled

If you could buy only one peripheral which would let your ZX/TS communicate with the real world, Ener-Z's Report Generator just might be it. The board's features include a real time clock, analog to digital interface, Input/Output ports and a Centronics printer interface. All those features, and the under $80 price tag, sounded like too good a buy to pass up to me, especially since one or two to these features alone would cost more than this board from most other vendors. Does the R.G. deliver? Let's take a look.

Physically, the R.G. board is 4" X 6" and has a cleanly designed physical layout for its 16 IC's and assorted passive components. Construction is professional, with few jumpers, plated through holes, and sockets for the more critical IC's. An on-board regulator is supplied. This helps to keep your ZX/TS's internal regulator cool. A battery holder is provided for the real time clock (RTC) and most of the offboard tie-ins can be made using standard DIP (dual-in-line pin) headers. These last are easy to obtain and inexpensive. In most uses, extra ground or Ø volts lines are provided. These fall between the active lines and should help keep down the effect of transients in your ribbon cables to the real world. The board plugs onto the ZX/TS expansion port and a through-edge connector is provided for other add-ons (e.g., RAMPACKS).

The heart of the R.G. board is a Z80 PIO (peripheral input/output) chip. Through the very clever use of an internal data bus (on the R.G. board), Ener-Z has expanded the capabilities of this simple chip to allow it to address what, in effect, are more than five (5) separate port configurations instead of the conventional two (2). Two versions of R.G. are available, one has all its software on a 2716 EPROM (mine is this type), the other has the driver software in RAM. The RAM version is required if you already are making use of the 2800H to 2B00H area where the EPROM version would normally reside. All functions on the R.G. board are made by USR calls to the appropriate subroutines on the EPROM, which, in turn executes the I/O functions.

An OKI MSM 58321 clock chip provides the year, month, day, week, hour, minutes and seconds for the RTC. With 3 Nicad batteries installed and the clock setting software (supplied as a listing) entered, you need only enter the correct time once and your ZX/TS will always know exactly what time it is. This is especially helpful if you want your ZX/TS to perform certain I/O functions at specified times.

Eight bit input and output ports are provided by a 74LS 244 buffer and 74LS 373 latch respectively. The inputs can monitor digital signals in the TTL range (0 or 5 volts). Real world signals can either be directly coupled to the buffer lines (e.g., simple switches) or coupled through conditioning circuits (e.g., relays). Outputs are also TTL compatible, through load carrying capacity is only moderate. To drive a large fanout or heavy load, you'd need a power amplifying/buffering stage (e.g., triac to run 110 volt circuits).

The analog converter section of the board uses a National ADC0809, eight bit, eight channel port to convert real world signals in the range of 0-5 volts into their digital equivalents. As an example, a measurement of about 50 means the ADC input is seeing about 1 volt d.c. With eight channels, you can monitor the status of 8 separate analogue devices. Typical uses here include monitoring rotary type joysticks (paddles), thermistors, photovoltaic cells, peak detector circuits and pressure transducers.

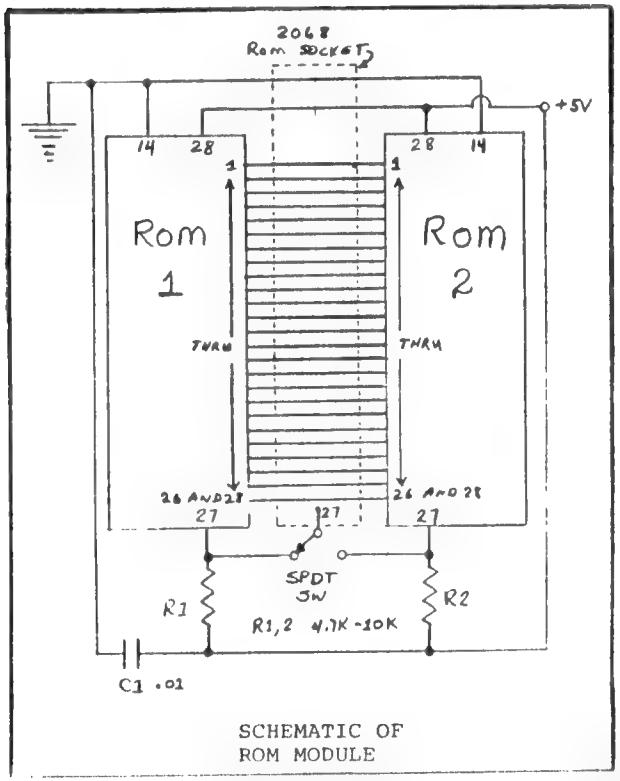
Up to this point we've seen how this board can tell what is happening offboard (input and A/D), know when it's happening (RTC) and even perhaps do something about what it sees (output). Now we're at the stage where, perhaps, you can see how the board got its name. The unit can also generate reports about what's going on, this time by using its final feature, a Centronics parrallel printer interface. For this important, high speed task the PIO ports are used directly. Eight data lines transmit ASC II character codes generated by a lookup table in the EPROM. The EPROM effectively "overlays" the Sinclair ROM for this operation, allowing the support of Sinclair's LPRINT, LCOPY AND LLIST commands directly, for the printing of the standard character set. Graphics are not directly supported, but special USR calls can produce a byte code which will produce other characters depending on your printer's capabilities. The overlay of Sinclair's ROM appears to be done with a tricky application of the $\overline{\text{ROMCS}}$ signal when the printer commands are invoked.

Carefully insert the ROM board assembly into the vacant ROM socket (U16) of the T/S 2068.
Dress the wires from the toggle switch into the computer cartridge section to avoid a possible short circuit.
Replace the top of the computer case . Do not replace the screws at this time.
Connect the power cable and video cable into the computer.
Apply power to your TV and activate the computer switch "ON".
If all is well, the copywrite message will appear on the TV screen.
If vertical lines appear on the screen, turn the computer off, flip the toggle switch to the opposite position and activate the computer switch again.
If everything is OK, turn off computer power, raise the top of the computer case and insert the other ROM IC into the vacant socket on the ROM board.
Drill a hole in the back of the computer case and install the toggle switch.
Reassemble the computer case with all hardware.
Flip the toggle switch to the opposite position and activate the power switch on the computer.
The copywrite(s) should appear on the screen on your monitor.

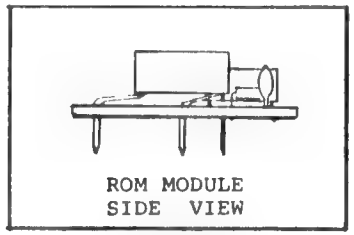
Parts required: 1 each unless otherwise noted

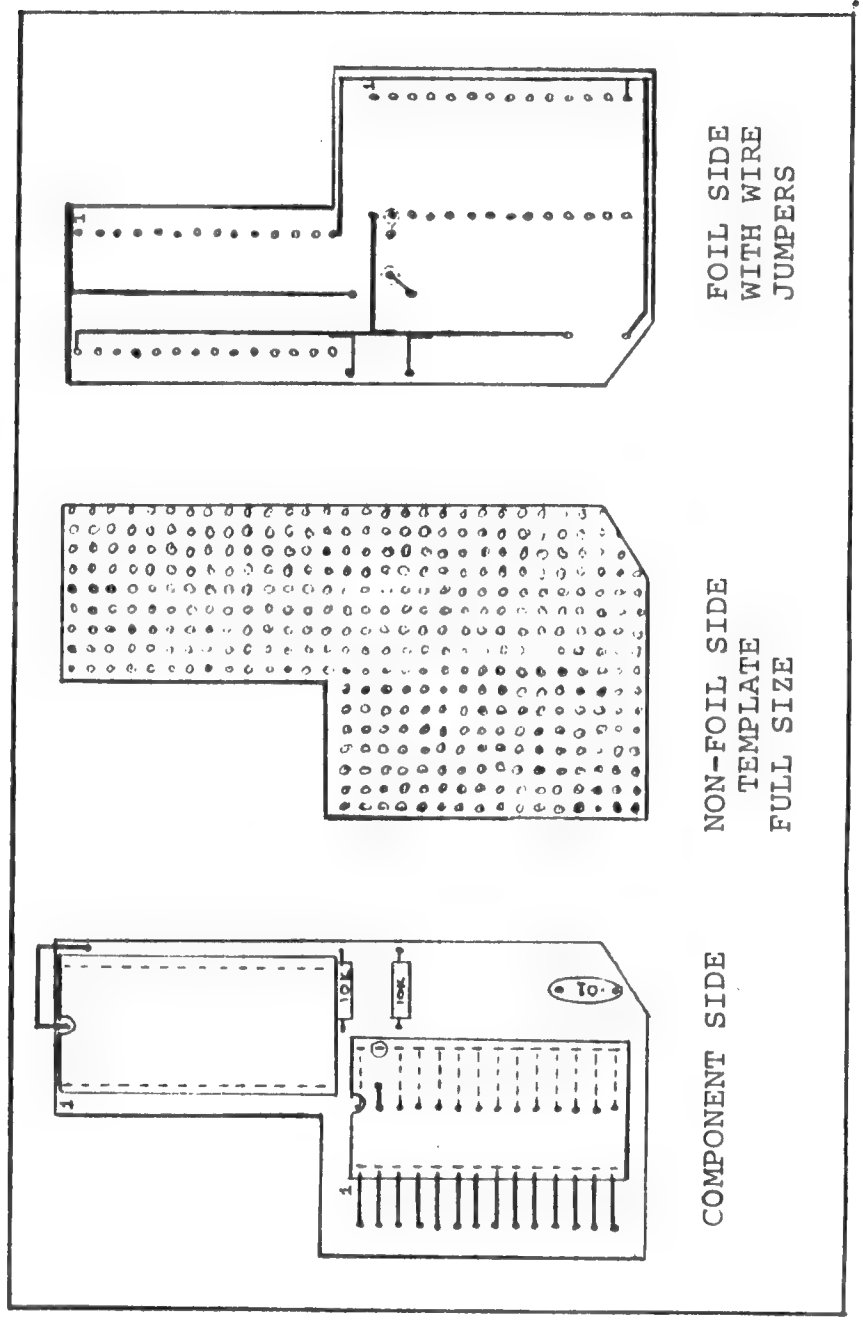
Conductive foam pad	Radio Shack 276-2400
Multi-Purpose Plug-In Breadboard	Radio Shack 276-155
Low Profile 28 pin IC socket	Radio Shack 276-1997
Wire Wrap Wire	Radio Shack 276-501
.01 Disc Cap	Radio Shack 272-131
2- 4.7K - 10K, 1/4 W resistors	Radio Shack 271-1335
Sub Mini Toggle Switch SPDT	Radio Shack 275-326
Wire Wrap socket, 3 level	DIGI-KEY, Highway 32 South, PO box 677, Thief River Falls,MN 56701

Happy Soldering.....Bob Gilder



SCHEMATIC OF ROM MODULE





L_I_S_T GROUP

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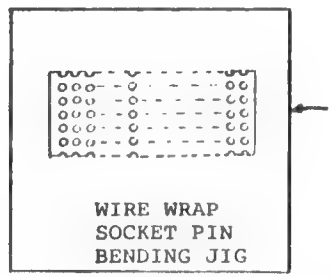
T/S 2068-SPECTRUM ROM MODULE

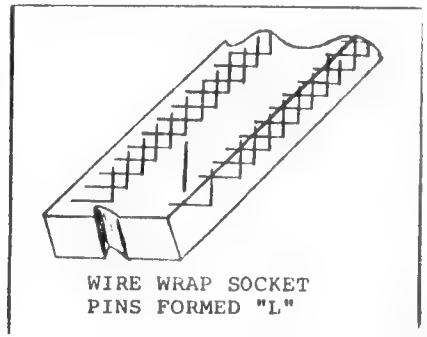
The following instructions for building a switchable ROM Module are for those individuals who are experienced at scratch building electronic projects. I have built 3 modules. Each one has operated with out a problem. If you decide to build a Module and cannot get it to operate properly, contact me in care of L.I.S.T. and I will do my best to try to assist. Lets get to it.

Open the computer case using instructions from last month's issue of L.I.S.T. and carefully remove the ROM (U16) from the socket. Place the ROM in foil or conductive foam.
Using the full size template provided, cut the PC grid board to size. Smooth all edges with a fine file.
Next step is to prepare a 28 pin, 3 level wire wrap socket into an offset socket.
Cut a small scrap of perforated PC board with 7 rows of holes.
Row 1 and row 7 must be cut along the perforations, leaving 5 rows of holes. This will become a lead bending jig.
Hold the 28 pin W/W socket with pin 1 facing away from you and to the left and all leads (pins) facing down.
Carefully bend pins 2 through 13 upwards and to the left.
Turn the socket over and place the lead bending jig, center row of holes over pins 1 and 14 and hold firm against the socket body.
Bend pins 2 through 13 upwards, aligning each pin along the perforated edge of the jig. Remove the jig and bend pins 1 and 14 down (as pins 2 through 13 were previously bent).
Lay the jig against pins 2 through 13, holding the jig firmly against the socket and bend up pins 1 and 14.
The remaining row of pins must be bent in the same direction as pins 1 through 14, however pins 27 and 15 must be used to secure the jig.
NOTE: Pin 27 MUST NOT BE BENT TO FORM AN "L". Pin 27 is used as a control select line for one of the ROMS.
Repeat the previous steps and bend pins 28, 26 through 15 to form an "L".
If the socket pins look a little irregular as to alignment, do not worry. Trial fit the socket into the PC board.
If a vise is available, place a small piece of wood between both rows of pins (bottom of PC board) and a thin section of scrap wood over the top of the socket and place in the vise. Slowly and carefully close the vise until the socket body is approximately 1/16" from the PC board.
Remove the assembly from the vise and straighten each of the 27 pins with a needle nose pliers.
Place a pencil mark at the location of missing pin 27 of the double row of pins; then remove the socket from the PC board.
Insert a stiff piece of wire (or a spare wire wrap pin) in the hole in the PC board previously marked with a pencil at pin location # 27. Bend the end of this pin to half loop (non copper side of PC board). The end of the loop should protrude through the PC board at a hole next to the pin. Solder in place.
Insert the wire wrap socket into each of its' 28 respective holes on the PC board.
When satisfied with the socket pin alignment, solder each of the 28 pins to the PC board.
Using a small fine tooth file, shape the inner and outter edges of the double row of socket pins to a chisel edge.
Carefully plug the PC assembly into the vacant ROM socket (U16) to insure clearance between the ROM board and the computer sub-assembly board. Remove the ROM board and file any areas required for additional clearance between both assemblies.

Place the low profile 28 pin socket into appropriate holes on the ROM board with pin 1 (or notch) on socket facing in the same direction as the wire wrap socket and solder in place.
Using the component side diagram, insert the .01mf capacitor into the PC board and bend both leads to secure in place.
Preform the leads on both 10K resistors and insert into the PC board and bend the leads to secure in place.
Strip the insulation from a 6" length of wire wrap wire and connect to pin 28 on one IC socket. Dress the wire along the bottom of the PC board and connect to pin 28 of the other IC socket. Solder both joints. This is the +5 volt bus.
Repeat the previous step, interconnecting pins 14 on both IC sockets. Solder both joints. This is the ground bus.
Bend the leads from the .01mf capacitor and connect one lead to the ground bus and the other lead to the +5 volt bus, then solder both connections.
Connect one lead from each 10K resistor to the +5 volt bus and solder these connections.
Connect and solder a short length of w/w wire to the free end of the 10K resistor closest to the low profile IC socket and connect and solder the other end of the wire to pin 27 on the low profile IC socket.
Connect the free end of the second 10K resistor to the straight through pin (27) on the wire wrap socket and solder in place.
Solder a short length of wire to pin 27 of the double row of pins. This is the single pin soldered in place earlier. Solder the other end of this wire to a pad close to both 10K resistor leads which connect to pins 27 on both IC sockets.
Take a break and carefully inspect all soldered connections for shorts and/or unsoldered joints.
Using wire wrap wire, interconnect pins 1 through 13 and 15 through 26 on both IC sockets, then solder in place. TAKE YOUR TIME and be careful not to create any solder bridges between socket pins. (Pin 1 on one socket connects to pin 1 on the other socket.....and so on).
Connect and solder an 8" length of wire at the junction of one 10K resistor and pin 27 of an IC socket.
Repeat previous step for the other 10K resistor/pin 27 junction.
Solder the free ends of the wires to the outside pins on the SPDT toggle switch. One wire to the N/O pin, the other to the N/C pin.
Connect and solder an 8" length of wire to the solder pad with a wire connecting to pin 27 of the double row of pins. Connect and solder the other end of this wire to the center pin on the switch.
Again, INSPECT ALL solder joints for any shorts. Use an ohm meter to check continuity of all parallel joints and between all socket pins.
If all is OK, insert the ROM board into a conductive foam pad.
Carefully place one ROM IC only into any one IC socket on the ROM board.



WIRE WRAP SOCKET PIN BENDING JIG



WIRE WRAP SOCKET PINS FORMED "L"

HARDWARE REVIEW

ITEM: EMU-1 SPECTRUM EMULATOR
FROM: DOUG DEWEY (ENTER LENGUA)
206 JAMES STREET
CARRBORO, N.C. 27510
FUNCTION: CONVERTS YOUR 2068 INTO A SPECTRUM
PRICE: $60.00 (INCLUDES P&P)

Doug Dewey's EMU-1 is a small (2" X 3"), open, double sided, p.c. board which plugs into the cartridge port of your 2068. It contains a 74LS155 for chip select and a 27128 EPROM, programmed to look like an LROS (Language ROM Oriented Software) package to the 2068. Once recognized by the system, LROS's take over control, and this one is programmed to act just like a Spectrum ROM.

I received my EMU-1 about 1 week ago and taking it out of its foil wrapped box with trembling fingers, inserted it into my 2068's cartridge port. It's a fairly snug fit, and close attention to the attached instruction sheet helps make the operation go smoothly. In addition to the insertion/removal instructions, Mr Dewey provides a 4 page letter describing the background and use of the board, some encouragements and warnings to prospective users.

Once you power up, the 2068 initializes itself and then checks the first few bytes of whatever is in the cartridge port. In this case, it finds there is another "language" you want to use and transfers control to that chip. (You could be running FORTH, for example). What you'll see on the screen at switch on is the familiar double copyright notice. Immediately however, as control is transferred to your "Spectrum" Eprom, the system reinitializes and only the @ 1982 Sinclair Research notice remains. When that happens, you've got yourself a Spectrum.

The board works well with all the Spectrum Software we could dig up (see lists), and since U.K. software sells for about 1/2 of its U.S. equivalent, a whole new world of computer power is available to you. We've even ordered PASCAL, the Hobbit and Jet Set Willy, based on the performance of the board.

There are some minor drawbacks to the board of which you should be aware. First, is the fact that its an open board. While this is somewhat objectionable from a cosmetic standpoint, more important is the possibility that you could damage the chips in handling. Take normal precautions to prevent static electricity buildup. Second, the edge connector is not gold plated. This means it can only take a limited (though still perhaps in the hundreds) number of insertions and removals before needing to be re-tinned. Again, you can correct this yourself, by having the edges gold plated. These are, as we said, minor complaints, and should prove to be of little importance to most users.

Finally, you should also be able to LOAD and run your existing library of BASIC programs with very little difficulty. The only commands that cause a problem for the interpreter are ON ERR, STICK, SOUND, and FREE. Peeks, Poke and USR's will work, but perhaps not as you expected, so check these also.

The EMU-1 is perhaps the most powerful add-on you can get for your 2068. With it, you'll have access to a tremendous installed base of UK software and still be able to use your 2068's extra capabilities and U.S. software. I rate the EMU a 9.7 out of 10.

CATALOGS RECIEVED

Integrated Data Systems 11 Brighton Avenue Toronto, Canada M4M 1P3 (416) 466 5571	Exceptionally Complete Catalogs for the ZX/TS & 2068 - The ZX/TS is 34 pages of full size type with descriptions.
John Oliger 11601 Whidbey Drive Cumberland, In. 46229	For the dedicated hardware enthusiast. Memory, Eprom (read & program) boards and connectors - Bare Boards and parts kits available (see SQ back issues).
BCD Electro PO Box 830119 Richardson, Tx 75083-0119	Disk Drives, Disks power supplies Disks at 1.00 each Drives @169.00ea
D. Lipinski Software 2737 Susquehana Road Roslyn, Pa. 19001	BASIC only home & business TS 1000 & 2068
E. Arthur Brown 3404 Pawnee Drive Alexandria, MN, 56308	Hardware & Software All at or near full list price. Claims availability of Smart II software.
Knighted Computers 707 Highland Street Fulton, N.Y. 13069	Most hardware & software Somewhat below list prices
P.V. Tubes 104 Abbey Street Accrington BBSIEE Lance	Software (Spectrum) and hardware replacement parts for ZX81 & Spectrum
Melbourne House Castle Yard House Castle Yard, Richmond TW106TF	Books & Software for Spectrum (e.g., ROM disassembly
Software Supermarket 87 Howards Lane London, England SW156NU	All Spectrum & ZX81 titles

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   If you have a program or article about something you've tried, please send it in. Our group interests are so varied that I can almost certainly guarantee that someone else can use your expertise to solve his problem.

THE CHANGELING

CONVERTING YOUR 2068 TO A SPECTRUM

Doug Dewey's EMU-1 is a convenient and effective way to achieve Spectrum emulation on your TS 2068. It has the distinct advantage of not requiring you to open up your machine and go mucking about inside. There are however, two other ways to provide Spectrum capabilities on your 2068.

The first, and least expensive, method is to replace your Timex ROM with a Spectrum ROM. These cost under $20.00 (see my ad) and installation is as follows:

1. Disconnect your computer from everything and clear a work space for your labors. Remember to ground yourself well to prevent static electricity from damaging your machine.

2. Turn your 2068 belly-up and loosen the seven Phillips head screws (3 large and 4 small).

3. Carefully, holding the sides of the case together, turn the machine back upright. The screws will fall out, if you haven't removed them, so make sure they don't get lost.

4. Place the machine on the table and slowly lift the top cover from the front. There is only one connection between the top (Keyboard) and bottom (circuit board) and that is the keyboard's flat cable. This cable is more durable than the ZX81 version, but is still easily damaged. You can now either prop up the top of the case, or better yet, carefully and slowly pull the flat cable out of its socket. Try to pull it out evenly by grasping it at either side using both hands (while the backs of your hands hold up the top case.

5. With the top removed, look for U16, the 16K ROM. We can ignore the other 8K chip (U20) as it is simply not used by the Spectrum. Using a IC extractor, remove U16. If you don't have an IC extractor, a screwdriver with a large flat, but thin blade and thin shank can be used. Place the tip of the driver between one end of the chip and its socket and twist slightly. When one end of the chip starts to move, go to the other end and repeat the operation. Keep doing this, a little at a time, until the chip is out. Place the chip in the back of the plastic foam pad in which your new Spectrum ROM is still sitting. (This is antistatic foam).

6. Make sure the pins on your new ROM are straight and then insert the chip, starting with one row and then the other into the socket. If the pins seem too wide apart, place the chip on its side on the table and gently roll it into the pins on one side, this should close up the gap, on all pins, slightly. Make sure you put pin 1 of the ROM where it belongs. Pin 1 is in the upper left hand corner of the chip. It is usually marked with a dot. Also the top of the chip will probably have a notch, as shown in the outline on the drawing.

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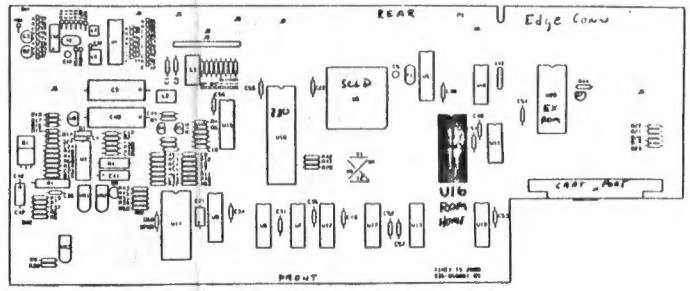
7. Seat the ROM fully and then reassemble the case by reversing the above procedure.

8. Turn on your Spectrum and have fun!

Another hardware method is shown in SUM (Sinclair/Timex Users Magazine), August '84 issue. (SUM is at 3224 N.W. 30th Avenue, Gainesville, Fla. 32605). In the article, a description of a simple "double" ROM board and switch is provided. You mount both Timex and Spectrum ROMS on the board along with a few resistors and an external switch. Construction plans for the board were not included in my copy of the magazine, so you'll have to write to them for that. However the job is straight-forward and consists of mounting the two chips on a small p.c. board. A hole has to be drilled in the back of the case for your select switch, but otherwise, given that you've already assembled the board, installation is the same as for the Spectrum ROM alone (given above). The big advantage of this system is, of course, the fact that the choice of ROM is switch selectable. Cost of the board is unknown, but a kit of that size normally sells for about $20.00 with all parts, but the ROM, (another $20.00).

Both systems, when configured as Spectrums, should work the same. I used the first method and have used my "Spectrum" on all the software listed in the table. Much of the U.S. software (which was converted U.K. stuff in the first place) will run on the "Spectrum" with little or no modification. In fact, I now use "Spectrum" almost exclusively, as BASIC programs I write for it all seem to work on the 2068 anyway.



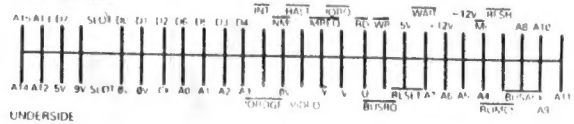
TS2068 PC BOARD COMPONENT LAYOUT

One last possibility, John Oliger sells 2068 cartridge read boards (meant to be AROS (Application ROM oriented Software) and thus mapped normally above 32K. However, his boards are remappable and it should be possible to use them, if not with Spectrum ROM then with a home-made EPROM, like Dewey's. Note the code differences between the 3 chips on the bottom of the page and compare this to what the TS 2068 technical manual says is needed for a LROS.

NOTE: THESE ARE DIFFERENT FROM THE TS 2068

The control, data and address busses are all exposed at the back of the Spectrum, so you can do almost anything with a Spectrum that you can with a Z80. Sometimes, though, the Spectrum hardware might get in the way. Here is a diagram of the exposed connections at the back.

COMPONENT SIDE

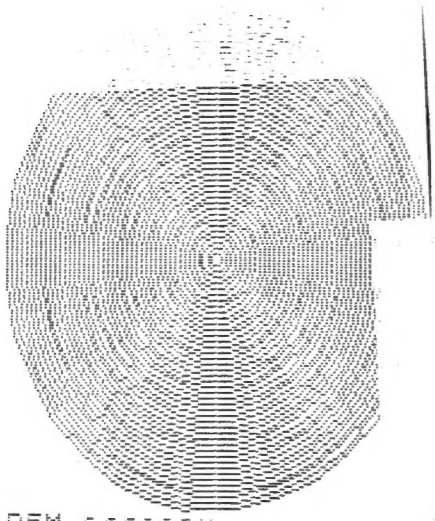


UNDERSIDE

There is a comprenensive look at adventure games in the last two chapters which I highly recommend to any serious D & D fans.

I only paid 1/2 price for my copy of the "Pocket Book" and felt it a good bargain at that price. Some other minor faux pas which contributed to downgrading the books value; bench-marks are promised for run times and not given, and 50 cycle references are not corrected to 60 cycles in his clock program.

Overall, I thought the book worth more than I paid for it, but perhaps not worth the list price.



```
1 REM screeny
2 LET sx=127: LET sy=87
3 CLS
5 PLOT sx,sy
6 CLS
10 FOR i=1 TO 100
20 CIRCLE
30
40
```

20 CIRCLE sy, sy, i+i
30 NEXT i
40 STOP

From TIMEX Tech Memo 0006

Table 3
JOYSTICK CONNECTOR SIGNAL ASSIGNMENT

PINS	SIGNAL NAME	FUNCTION
1	$\overline{\text{DIR1}}$	Direction One (active low).
2	$\overline{\text{DIR2}}$	Direction Two (active low).
3	$\overline{\text{DIR3}}$	Direction Three (active low).
4	$\overline{\text{DIR4}}$	Direction Four (active low).
5	-	Not used.
6	$\overline{\text{BUTTON}}$	Button Input (active low).
7	5V	+5 VOLTS
8	RDSTB	Read strobe.
9	-	Not used.

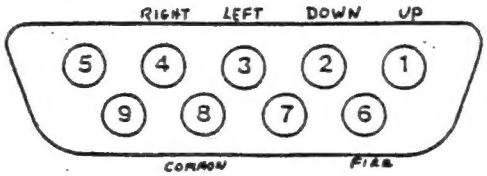
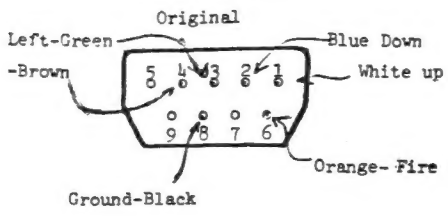


Figure 3 JOYSTICK CONNECTOR

JOYSTICK CONNECTORS

The T/S 2000 has the built-in capability to use two eight-position joysticks. These joysticks are industry-standard. The connectors are industry-standard 9-pin "D" type connectors. The layout of the connector, and the function of each pin is given below in Table 3 and Figure 3.

ATARI CONTROLLER



Only ● has contacts

Fig 1(a)

Uses Quik Connect Terminals For Edge Connectors

Original Circuit Pattern

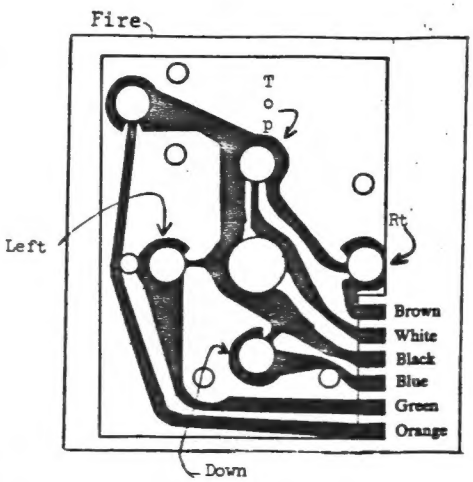


Fig. 1(b)

BOOK REVIEW THE ZX81 Pocket Book

AUTHOR: TREVOR TOMS (1981)

FROM: Reston Publishing Co. Inc.
Reston, Va. (Prentice Hall)

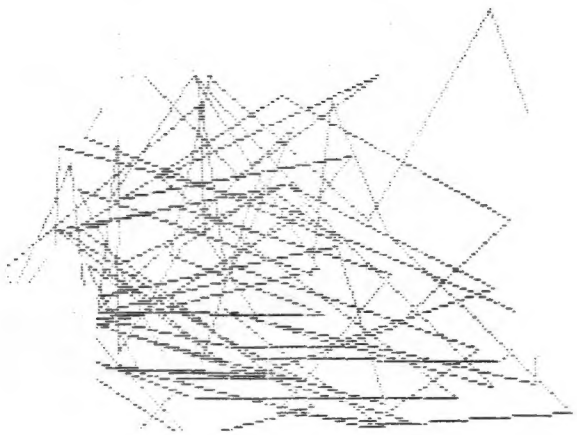
COST: $10.95

Trevor Toms "Pocket Book" is a handy little compilation of hints and tips for programming your ZX81 - TS/1000. It is 128 pages long and is divided up into 9 easy-to follow chapters. There are practically no typos, which I thought quite unusual until I learned that Mr. Toms used a Panasonic JD800 with Wordstar to compose the text.

As with most other texts of this type, it is assumed you have already read the originally supplied BASIC Manual. The first few chapters begin by presenting in termediate programming techniques, string searches and handling, efficient programming (conserving memory or increasing speed), "Big" characters, decimal justification and miscellaneous tips. Many of these are quite valuable to readers with the unexpanded ZX/TS computer and most are reasonable well explained. Mr. Toms does tend to carry variables around outside his subroutine listings which is somewhat annoying, but is, after all, the way the computer does it. His "Big" characters program could use somewhat more explanation, but does show two very interesting ways to address the problem. An example of the valuable little tips is the following short program line:

200 PAUSE 4E4

Which can be pronounced "pause Four-ee-Four" and means just that; as 40000 is greater than 32,767 and the computer will wait for a keystroke, "forever".



```
LET SX=127  LET SY=87
PLOT SX,SY
FOR I=1 TO 100
LET X=INT (RND*127)
LET Y=INT (RND*85)
LET Z=INT (RND*40)
IF ((INT (RND*3+.05))>1) TH
N LET X=(X*(-1))
IF (INT (RND*3)>1) THEN LET
Y=(Y*(-1))
LET X1=SX+X
LET Y1=SY-Y
IF (X1>255 OR X1<=0) T
HEN GO TO 80
160 IF (Y1>175 OR Y1<=0) TH
EN GO TO 80
180 IF ((X1+Z)>=255 OR (X1-Z)<
0 OR (Y1+Z)>=175 OR (Y1+Z)<=0
THEN GO TO 80
DRAW X,Y
LET SX=X1 LET SY=Y1
```

In chapter 7 we address machine code. Mr. Toms demonstrates the use of REM statements, arrays and the area above RAMTOP for storing machine code. A valuable list of the advantages and disadvantages of each storage area is provided. Of particular interest is his use of "relative" jumps using lines like:

120 GOTO USR X+200

There is an excellent opportunity for implementing READ, DATA and RESTORE through the use this technique, coupled with string slicing, simply by putting your DATA values in REM statements.

A "rather deluxe" monitor is provided. Actually I found it rather "basic". A variable loader program is supplied and this is fairly efficient, but Mr. Toms assumes that his readers know how to change one variable in a list of subscripted variables without rerunning the entire program. I have found this not to be the case with many users.